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HOUSE OF REPRESENTATIVES
REPORT
101-174

SCHEDULE FOR INSTALLATION OF THE TCAS-II COLLISION AVOIDANCE SYSTEM

JULY 26, 1989.—Committed to the Committee of the Whole House on the State of the Union and ordered to be printed

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Mr. ANDERSON, from the Committee on Public Works and Transportation, submitted the following

REPORT

[To accompany H.R. 2151]

[Including cost estimate of the Congressional Budget Office]

The Committee on Public Works and Transportation, to whom was referred the bill (H.R. 2151) to amend the Federal Aviation Act of 1958 to establish a schedule for the installation in certain civil aircraft of the collision avoidance system known as TCAS-II, and for other purposes, having considered the same, report favorably thereon with an amendment and recommend that the bill as amended do pass.

The amendment strikes out all after the enacting clause of the bill and inserts a new text which appears in italic type in the reported bill.

BACKGROUND OF THE LEGISLATION; PUBLIC LAW 100-223

On December 30, 1987, Public Law 100-223, the Airport and Airway Safety and Capacity Expansion Act of 1987 was enacted. Among the provisions were amendments to the Federal Aviation Act of 1958 establishing a new section 601(f) requiring that collision avoidance technology known as the Traffic Alert and Collision Avoidance System (TCAS-II) be installed on all commercial aircraft of at least 30 seats within approximately four years of enactment.

This four year schedule was divided into two phases. First, the Federal Aviation Administration was directed to implement a schedule to complete certification and operational approval of the TCAS-II technology within 18 months of enactment. Second, the Federal Aviation Administration was directed to issue regulations

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that would require the airlines to install the TCAS–II equipment within 30 months of certification and approval.

On January 10, 1989, the FAA issued a Final Rule requiring that all commercial aircraft with 30 or more seats be equipped with the TCAS–II equipment by December 30, 1991.

Public Law 100–223 also required all aircraft to be equipped with Mode C altitude encoding transponders for operations in high density traffic areas. The legislation also directed the FAA to complete research, development and certification of the more advanced version of the collision avoidance technology, TCAS–III, and authorized appropriations from the Airport and Airway Trust Fund to carry out that research, development, and certification.

SUMMARY OF H.R. 2151

The reported bill amends Section 601(f) of the Federal Aviation Act of 1958 to provide for:

(1) A year long operational evaluation of TCAS–II beginning not later than December 30, 1990.

(2) An extension of the deadline for installing TCAS–II beyond the current December 30, 1991, compliance deadline for up to two years if the FAA Administrator determines that extending the deadline is necessary to promote a safe and orderly transition to a fully equipped TCAS–II fleet or for other safety purposes. An extension beyond two years can be made if the Administrator finds that an extension is necessary to promote safety and if the Congressional Committees with jurisdiction are notified 90 days in advance.

(3) Directives to the Administrator to consider the feasibility and desirability of amending the compliance schedule for airborne wind shear equipment to make it compatible with the TCAS compliance schedule.

THE TCAS TECHNOLOGY

Collision avoidance technology has been under development since the 1950s. A number of conceptual approaches have been evaluated and discarded. In 1981, the FAA announced that the approach it would pursue would be a collision avoidance system that reacted to transponder signals from other aircraft. This system was designated the Traffic Alert and Collision Avoidance System (TCAS).

TCAS is a sophisticated system of antennas, computer processing, displays, and aural warnings, all carried on board an aircraft. The system is totally independent of ground-based air traffic control.

The TCAS antennas receive signals from other aircraft's transponder equipment. Transponders are devices that provide enhanced radar images and altitude and identification information to air traffic controllers. Transponders with altitude encoding capabilities are required equipment around Terminal Control Areas (the airspace around the 27 busiest airports) and above 10,000 feet. By the end of 1990, altitude encoding transponders will be required in the vicinity of approximately 110 other airports.

The computer processor takes the transponder signals from other aircraft and determines those aircrafts' trajectories and compares them with the trajectory of the TCAS equipped aircraft. If the air-

craft continue on their respective trajectories and would come within several miles of each other, the pilot of the TCAS equipped aircraft will be advised. If the processor determines that the trajectories would result in a conflict, the pilot will be provided a "climb" or "descend" advisory approximately 30 seconds in advance of the closest potential encounter. In most circumstances, this would well precede the ability for any visual siting of the conflicting aircraft.

Pilots who have operated TCAS equipped aircraft are very enthusiastic about the equipment. United Airlines was involved in one of the recent evaluations of the equipment in which a TCAS equipped aircraft was operated in routine passenger carrying operations. The United Airlines evaluation report stated: "The pilots felt naked without TCAS when the evaluation was over."

TCAS is actually a family of systems with different levels of capability. The TCAS–I, which will be required on small 10–30 seat commuter aircraft by 1995, provides displays and visual and aural traffic advisories to pilots, but no directives of how to avoid conflicts. TCAS–II provides vertical (climb or descend) directives to avoid conflicts. TCAS–III, the most advanced system, is still under development. TCAS–III provides horizontal directives in addition to the vertical directives.

The cost of installing TCAS–II is estimated to be $310,000 per aircraft including revenue lost while the aircraft is out of service. For the current fleet of approximately 3,900 aircraft to which the requirements apply, the total cost to the industry is estimated to be approximately $1.2 billion.

THE NEED FOR COLLISION AVOIDANCE TECHNOLOGY

Mid-air collisions involving airline aircraft are extremely rare events, however their consequences are catastrophic. In the past 11 years there have been four mid-air collisions resulting in 253 deaths.

In September 1978, a Pacific Southwest Airlines Boeing 727 aircraft collided with a general aviation aircraft, killing 144 people, including 7 on the ground. In August 1984, a Wings West Airlines Beech 99 commuter aircraft crashed after colliding with a general aviation aircraft over San Luis Obispo, California resulting in 17 deaths. In August 1986, an Aeromexico Boeing 727 aircraft on approach to Los Angeles International Airport was struck by a general aviation aircraft within the Terminal Control Area over Cerritos, California killing 82 people including 15 on the ground. And in January 1987, a Sky West Airlines Metroliner aircraft collided with a general aviation aircraft killing 10 people.

The FAA has testified that had TCAS–II been on board the airline aircraft involved in the mid-air collisions described above, these accidents would have been prevented.

Reports of near mid-air collisions involving airline aircraft also began to climb dramatically after 1984. Near mid-air collision reports involving airlines aircraft went from 224 in 1984 to 489 in 1987. Investigation of the most serious of these mid-air incidents indicates that during this period luck was a part of our system for keeping aircraft from running into each other.

Near mid-air collision reports continue to be too high, but beginning in late 1987 and continuing to the present, reports of near mid-air collision reports have dropped dramatically. In 1988, reports involving airline aircraft numbered 328, and the trend in 1989 is 23 percent below the year to date total for 1988. This decline is attributed to wider use of Mode C altitude encoding transponders on general aviation aircraft around major hub airports and improved pilot education and awareness. Though this trend is certainly welcome and represents an improvement in safety, the most recent figures indicate that approximately five times a week, the pilots of airline aircraft report encounters with other craft tht were close enough to prompt the filing of a report with the FAA for investigation. Installation of TCAS–II is expected to dramatically reduce these "close calls" involving airline aircraft.

Finally, airline traffic is forecast to continue growing at a rapid pace for the balance of this century, and the airways, particularly around the hub airports, will become increasingly congested. For this growth to be accommodated safely, TCAS–II will be required to augment the ground based system in order to keep aircraft separated.

RECENT CONCERNS ON TCAS–II IMPLEMENTATION SCHEDULE

Substantial progress has been made since enactment of Public Law 100–223 toward certification of TCAS–II; nonetheless, in late 1988, the Federal Aviation Administration and the airline industry began expressing concerns on two scores about TCAS–II implementation: (1) The need for a large scale operational evaluation and test of TCAS–II, and (2) the concern that there may not be sufficient maintenance, engineering, and technical capabilities to meet the 1991 compliance deadline in an orderly manner.

Congress requested that the Office of Technology Assessment evaluate these concerns. OTA's report entitled "Safe Skies With TCAS" was issued in February 1989, and generally concluded that the concerns of the FAA and the industry were valid.

First, with respect to the need for a large scale operational test evaluation, the OTA concluded that such an evaluation would be beneficial. Each of the confined installation programs to date have been confined to a very few aircraft and were aimed at working computer software "bugs" out of the system, making other refinements, and basically validating the technology.

What has not been evaluated is the TCAS–II equipment operating in an environment with numerous other aircraft equipped with TCAS–II and how large numbers of airline pilots and the ground based air traffic control system will respond in a system with large numbers of TCAS–II equipped aircraft. Though there is not a strong sense that there is a significant unforeseen problem looming, past experience with the implementation of new technologies indicates that a large scale evaluation and test would benefit the overall implementation.

The OTA cited the Ground Proximity Warning System as an example of a fleet implementation that did not involve a large scale operational test and evaluation and one in which technical problems plagued the system after full implementation. This resulted in

the loss of pilot confidence in the GPWS, and this loss of confidence became a factor in some accidents.

The OTA concluded:

> * * * that an evaluation program that includes early implementation of TCAS in a substantial portion of the fleet would benefit safety. Without such a program, the worst case scenario is that the airlines could completely outfit their fleets only to learn that a technical glitch requires major modification of the current TCAS equipment. A structured evaluation phase would allow problems to be identified early, preventing further installation of flawed units and permitting modifications soon enough in the installation program to minimize costs.

The second area of concern about the compliance deadline of 1991 was the ability of the industry to accomplish the required work in an orderly fashion.

The next few years will see a number of very significant equipment installation programs and aircraft modifications that will address a number of vexing and long standing safety problems. Not only is TCAS–II being required, but also new wind shear detection and guidance equipment as well as new flight data recorders that will provide much more and better information to accident and incident investigators. Also, requirements have recently been imposed for large scale structural modifications for many of the older aircraft in the fleet.

All of these new initiatives will be time consuming and require many man hours to accomplish. At the time the 1991 compliance deadline for TCAS was established, Congress and the FAA had not yet developed requirements for wind shear and flight data recorder equipment or the recently required structural modifications.

The OTA concluded with respect to the current compliance schedule:

> If TCAS–II production rate is sufficient, FAA certification resources are available, and no technical barriers develop, TCAS–II could be installed in most of the U.S. fleet by December 30, 1991. However, OTA concludes that delays especially those facing commuter and special configuration aircraft will probably prevent 100 per cent compliance.

The OTA also found that the TCAS–II implementations schedule could be improved by coupling an extension of the final compliance deadline with interim deadlines for certain proportions of airline fleets to be TCAS–II equipped. For instance, 25 percent of an airline's fleet could be required by the end of 1990, 50 percent by the end of 1991 with full 100 percent compliance at the end of 1993.

Such a schedule could actually accelerate a number of carriers' getting some of their aircraft equipped with TCAS–II rather than wait to get all of their fleet done late in the current compliance schedule. This would enhance safety by requiring some aircraft to be TCAS–II equipped earlier than they otherwise would have been.

There have also been proposals by the FAA and industry to make the new wind shear detection and guidance equipment re-

quirements compatible with any new TCAS–II requirements so that the costs of installation and aircraft downtime could be minimized because airlines would have greater flexibility to schedule both equipment installations at the same time.

MODIFICATION OF COMPLIANCE DEADLINES

The Committee generally believes that tight deadlines for compliance are beneficial in forcing actions that otherwise might not occur. The TCAS provisions of Public Law 100–223 enacted a year and a half ago are a good case in point. Work by government and industry on collision avoidance had proceeded for almost 30 years, but only when it became enough of a priority to warrant statutory deadlines imposed by Congress were there actions to finally bring all the work on collision avoidance to fruition. Now, it appears that some changes may be in order to provide for an operational evaluation and allow more time for final compliance.

Under the reported bill, if the FAA decides to modify the compliance schedule for TCAS–II, the agency can only do so upon findings that such changes are required for a "* * * safe and orderly transition to operation of a fleet of civil aircraft * * * equipped with * * * TCAS" or "* * * to promote other safety objectives."

The Committee looks upon these criteria for modifying the deadline as narrow. The industry should not expect any exemptions or relief from the deadlines because an airline's plans to comply on a timely basis were not made early on. Lack of action by a carrier today should not serve as a reason or excuse for not being in compliance when the deadline arrives. The Committee observes that those companies covered by the regulations should already be placing purchase orders for the TCAS equipment and making arrangements to install this equipment, without expecting any compliance schedule changes.

PENDING FEDERAL AVIATION ADMINISTRATION ACTIONS

On July 10, the FAA announced in the Federal Register that it will hold public meetings on August 16 and 17, 1989, to discuss possible changes to the regulations governing the TCAS and wind shear equipment compliance schedules. This regulatory action is anticipatory of enactment of H.R. 2151. The FAA is to be commended for taking these steps rather than waiting for conclusion of the legislative process. If and when this legislation is enacted into law, the FAA will be in a position to act quickly.

The FAA in its notice for the public meeting has requested comment on a modified TCAS–II compliance schedule that would require 20 percent of an airline's fleet to be equipped by December 30, 1990, 50 percent by December 30, 1991, and 100 percent by December 30, 1993.

The Committee believes it is important that the industry have early notice of any changes to the compliance schedule so all parties have a deadline firmly established well in advance so necessary arrangements can be made to comply.

TCAS–III DEVELOPMENT AND CERTIFICATION

In enacting this legislation it is not the intent of Congress to reduce the importance of the development and certification of the collision avoidance system known as TCAS–III. The Administrator shall actively continue the work necessary to insure TCAS–III is certified at the earliest possible date.

SECTION-BY-SECTION DESCRIPTION OF H.R. 2151

The bill makes the following changes to Section 601(f) of the Federal Aviation Act of 1958:

Renumbers subsection (3) of Section 601(f) of the Federal Aviation Act of 1958 as subsection (6).

Amends Section 601(f) of the Federal Aviation Act of 1958 by adding a new subsection "(3) Operational Evaluation". The Administrator is directed to institute a year long operational evaluation of the TCAS–II collision avoidance technology beginning not later than December 30, 1990. The purpose of this evaluation is to collect and assess safety and operational data from aircraft equipped with TCAS–II. The new subsection also directs the Administrator to encourage the participation of foreign air carriers which operate civil aircraft equipped with such systems.

It is the intent of the Committee that the operational evaluation required by this new subsection be conducted with the number of aircraft necessary to reasonably measure the impact of TCAS on the air traffic control system and assess the interaction between a significant number of TCAS–II equipped aircraft. The Committee believes that the evaulation should include a representative number of regional commuter aircraft. Also, the major thrust of the evaluation should focus on busy terminal areas as this is where the interaction will be most prevalent.

The Committee also recognizes the need for a continuing increase in the number of TCAS–II equipped aircraft during the evaluation. This is necessary to insure that examination of TCAS–II's compatibility with both the ATC system and a system with numerous operating TCAS–II units is not limited to a small initial number of TCAS–II equipped aircraft.

Amends Section 601(f) of the Federal Aviation Act of 1958 by adding a new subsection "(4) Extension of Time." If the Administrator determines that extending the deadline contained in Section 601(f)(2) is necessary to promote a safe and orderly transition to the operation of a fleet of civil aircraft equipped with TCAS–II or to promote other safety objectives, the Administrator may extend the deadline for a period not to exceed two years. The Administrator may further extend the deadline beyond two years if he determines that a further extension is necessary to promote safety, and he notifies in writing the Committee on Public Works and Transportation of the House of Representatives and the Committee on Commerce, Science, and Transportation of the Senate at least 90 days before such extension is to take effect.

COMMITTEE ACTION AND VOTE

With respect to clause 2(l)(2) (A) and (B) of rule XI of the Rules of the House of Representatives, the Committee with a majority present, favorably reported H.R. 2151 as amended by a voice vote on July 20, 1989.

Prior to Committee consideration and vote, the Subcommittee on Aviation held hearings on H.R. 2151 on May 4, 1989, and on July 18, 1989, the Subcommittee on Aviation considered and reported H.R. 2151 as amended to the Committee.

OVERSIGHT FINDINGS AND RECOMMENDATIONS

With respect to clause 2(l)(3) (A) and (B) of rule XI of the Rules of the House of Representatives, the Committee reports that no report has been received from the Subcommittee on Investigations and Oversight on the subject matter.

With respect to clause 2(l)(3)(D) of rule XI of the Rules of the House of Representatives, the Committee has not received a report from the Committee on Government Operations pertaining to the subject matter.

CONGRESSIONAL BUDGET ACT REQUIREMENTS

With respect to clause 2(l)(3)(B) of rule XI of the Rules of the House of Representatives, and in compliance with section 308(a) of the Congressional Budget Act of 1974, the Committee reports that H.R. 2151, as reported by the Committee, does not create new budget authority and does not create new or increased tax expenditures.

With respect to clause 2(l)(3)(B) of rule XI of the Rules of the House of Representatives, the Committee has received the following report from the Congressional Budget Office under section 403 of the Congressional Budget Act of 1974:

U.S. CONGRESS,
CONGRESSIONAL BUDGET OFFICE,
Washington, DC, July 21, 1989.

Hon. GLENN M. ANDERSON,
Chairman, Committee on Public Works and Transportation, U.S. House of Representatives, Washington, DC.

DEAR MR. CHAIRMAN: The Congressional Budget Office has reviewed H.R. 2151, a bill to amend the Federal Aviation Act of 1958 to establish a schedule for the installation in certain civil aircraft of the collision avoidance system known as TCAS–II, and for other purposes, as ordered reported by the House Committee on Public Works and Transportation on July 20, 1989. We estimate that implementation of the bill would cost the federal government $6 million to $7 million, primarily in fiscal year 1990, assuming appropriation of the necessary funds.

H.R. 2151 would require the Administrator of the Federal Aviation Administration (FAA) to institute (not later than December 30, 1990) a one-year program to evaluate the collision avoidance system known as TCAS–II (Traffic Alert and Collision Avoidance System). The bill would also allow the Administrator to extend the

deadline for the installation and operation of TCAS–II by up to two years; the deadline could be further extended if the Administrator properly notifies the appropriate Congressional committees. In addition, H.R. 2151 would require the Administrator to consider the feasibility and desirability of amending the schedule for the installation of airborne low-altitude windshear equipment in order to make it compatible with the schedule for the installation of TCAS–II.

Based on information from the FAA, CBO estimates that implementation of this bill would result in costs to the federal government of $6 million to $7 million to purchase, operate and analyze information from recording devices that would monitor certain cockpit and air traffic facility readings in order to evaluate TCAS–II. We anticipate that such costs would be incurred primarily in fiscal year 1990. It is possible that some of these costs would be incurred without this legislation, since the FAA might perform some type of evaluation of TCAS–II prior to its full implementation in any event. There would be no significant cost to the federal government associated with the other provisions of H.R. 2151.

No costs would be incurred by state or local governments as a result of enactment of this bill.

If you wish further details on this estimate, we will be pleased to provide them. The CBO staff contact is Mitchell Rosenfeld, who can be reached at 226–2860.

Sincerely,

ROBERT D. REISCHAUER,
Director.

INFLATIONARY IMPACT ANALYSIS

With respect to clause 2(l)(4) of rule XI of the Rules of the House of Representatives, the Committee reports that there should be no inflationary impact on prices and costs in the operation of the national economy by enactment of H.R. 2151.

COST ESTIMATE OF LEGISLATION

With respect to clause 7(A)(1) of rule XIII of the Rules of the House of Representatives, the Committee reports that H.R. 2151 would result in no significant additional cost to the Federal government.

With respect to clause 7(A)(2) of rule XIII of the Rules of the House of Representatives, the Committee reports that no cost estimate of H.R. 2151 was submitted to the Committee by a government agency.

CHANGES IN EXISTING LAW MADE BY THE BILL, AS REPORTED

In compliance with clause 3 of rule XIII of the Rules of the House of Representatives, changes in existing law made by the bill, as reported, are shown as follows (existing law proposed to be omitted is enclosed in black brackets, new matter is printed in italic, existing law in which no change is proposed is shown in roman):

SECTION 601 OF THE FEDERAL AVIATION ACT OF 1958

TITLE VI—SAFETY REGULATION OF CIVIL AERONAUTICS

GENERAL SAFETY POWERS AND DUTIES

MINIMUM STANDARDS; RULES AND REGULATIONS

SEC. 601. (a) * * *

* * * * * * *

(f) COLLISION AVOIDANCE SYSTEMS.—

(1) * * *

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(3) OPERATIONAL EVALUATION.—The Administrator shall institute, for a 1-year period beginning not later than December 30, 1990, a program for the operational evaluation of the collision avoidance system known as TCAS–II, in order to collect and assess safety and operational data from the civil aircraft equipped with such system. In conducting the program, the Administrator shall encourage the participation of foreign air carriers which operate civil aircraft equipped with such system.

(4) EXTENSION OF TIME.—If the Administrator determines that extending the deadline contained in paragraph (2) is necessary—

(A) to promote a safe and orderly transition to operation of a fleet of civil aircraft described in paragraph (2) which is equipped with the collision avoidance system known as TCAS–II, or

(B) to promote other safety objectives, the Administrator may extend such deadline for a period not to exceed 2 years; except that the Administrator may further extend such deadline if the Administrator determines that such further extension is necessary to promote aviation safety and notifies, in writing, the Committee on Public Works and Transportation of the House of Representatives and the Committee on Commerce, Science, and Transportation of the Senate of such extension at least 90 days before such extension is to take effect.

(5) COMPATIBILITY OF WINDSHEAR EQUIPMENT INSTALLATION SCHEDULE.—The Administrator shall consider the feasibility and desirability of amending the schedule for the installation of airborne low-altitude windshear equipment in order to make such schedule compatible with the schedule for the installation of the collision avoidance system known as TCAS–II.

[(3)**]** *(6)* TRANSPONDERS.—Not later than 6 months after the date of the enactment of this subsection, the Administrator shall promulgate a final rule requiring the installation and use of operating transponders with automatic altitude reporting capability for aircraft operating in designated terminal airspace where radar service is provided for separation of aircraft. For such terminal airspace, other than Terminal Control Areas and Airport Radar Service Areas, the Administrator may provide for access to such airspace by nonequipped aircraft if the Administrator determines that such access will not interfere

with the normal traffic flow. Such final rule shall require the installation and use of such transponders not later than 36 months after the date of the enactment of this subsection.

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